MOOSE SURVEY
Yukon and Tatchun Rivers
LATE-WINTER 2007

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TR-13-11

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Summary

- We conducted a late-winter survey of moose along the Yukon River from Carmacks to Minto on 1-6 March 2007, using fixed-wing aircraft. The main purpose of this survey was to map the distribution and late-winter habitats of moose in this area.
- We flew over the entire survey area and spent about 0.69 minutes per km² searching for moose. We found a total of 76 moose, of which 62 were adults and 14 were calves.
- Moose were widely distributed across the survey area. Most were seen in willow-rich habitats in recently burned areas in the northern part of the survey area; relatively few were in the main Yukon River valley. The biggest concentration of moose was in the hills in the Minto area which burned in a fire in 1995.
- About 18% of moose seen in the survey were calves. This may be negatively biased because of lower sightability of cows with calves, but it is relatively high compared to other late-winter surveys, so recruitment appears to have been good this year in this area.

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Introduction

This report summarises the results of the late-winter survey of moose along the Yukon River between Carmacks and Minto (see Map 1), conducted 1-6 March 2007. The survey included parts of the Carmacks West and Tatchun Moose Management Units. The main purpose of the survey was to map the distribution and late-winter habitats of moose in this area.

Previous Surveys

Environment Yukon has not previously surveyed moose during late winter in most of the 2007 survey area. There have been 3 surveys in previous years in areas that overlapped with this survey area (see Map 2). Environment Yukon and Selkirk First Nation conducted an early-winter survey in 2000 over a very large area up the Pelly and Macmillan rivers that included the area north and east of the Klondike Highway and Frenchman Lake road (results in Environment Yukon 2003). In March 2001, Environment Yukon and Selkirk First Nation also funded a survey to map late-winter distribution of moose over most of the 2000 survey area (results in O'Donoghue 2005). We also conducted an early-winter census of moose, that was only partially completed because of poor weather, in an area that included the western part of the 2007 survey area (results in O'Donoghue et al. 2008).

Community Involvement

This survey was conducted largely because the riparian habitat along the Yukon River was identified as regionally important moose habitat by residents of the Carmacks area during planning sessions for developing the *Community-based Fish and Wildlife Management Plan for the Little Salmon/ Carmacks First Nation Traditional Territory, 2004-2009.* Interest in mapping seasonally important habitats has also been expressed at annual Northern Tutchone May Gatherings. The Yukon River is an important hunting area for both the Little Salmon/Carmacks and Selkirk First Nations. Little Salmon/Carmacks First Nation provided staff to help conduct this survey.

Study Area

The survey area was located to cover the Yukon River valley north of Carmacks, within the Little Salmon/Carmacks First Nation traditional territory. East and west boundaries generally followed the height of land on either side of the river. The survey area was about 1,620 km^2, and included parts of Game Management Subzones 4-13, 4-14, 5-24, and 5-26 (see Map 1).

The study area was centered on the Yukon River valley, which is mostly vegetated with dense spruce and poplar forest with numerous sloughs, islands, and riparian willow flats. Forests on the west-facing slopes of the river are broken by open grassy bluffs in many places. The terrain is mostly rolling hills

and plateaus, dissected by numerous creeks, with the Wood Cutters Range, Tatchun River, and Tatchun Lake to the east. Most of the area is forest-covered with black and white spruce, lodgepole pine, aspen, and paper birch. Willows and dwarf birch are the main shrub species, and are especially dense along river and creek valleys and in recent burns. There are some unvegetated rocky outcrops and open areas on higher ridges, especially in the Wood Cutters Range, and several deep canyons along creeks. Old and recent burns occur in the north and south of the study area (see Map 3), and these vary in quality as moose habitat. The largest fires were the 1,144 km² burn in the northern part of the survey area in 1995, and a 254 km² burn south of Tatchun Lake in 1958.

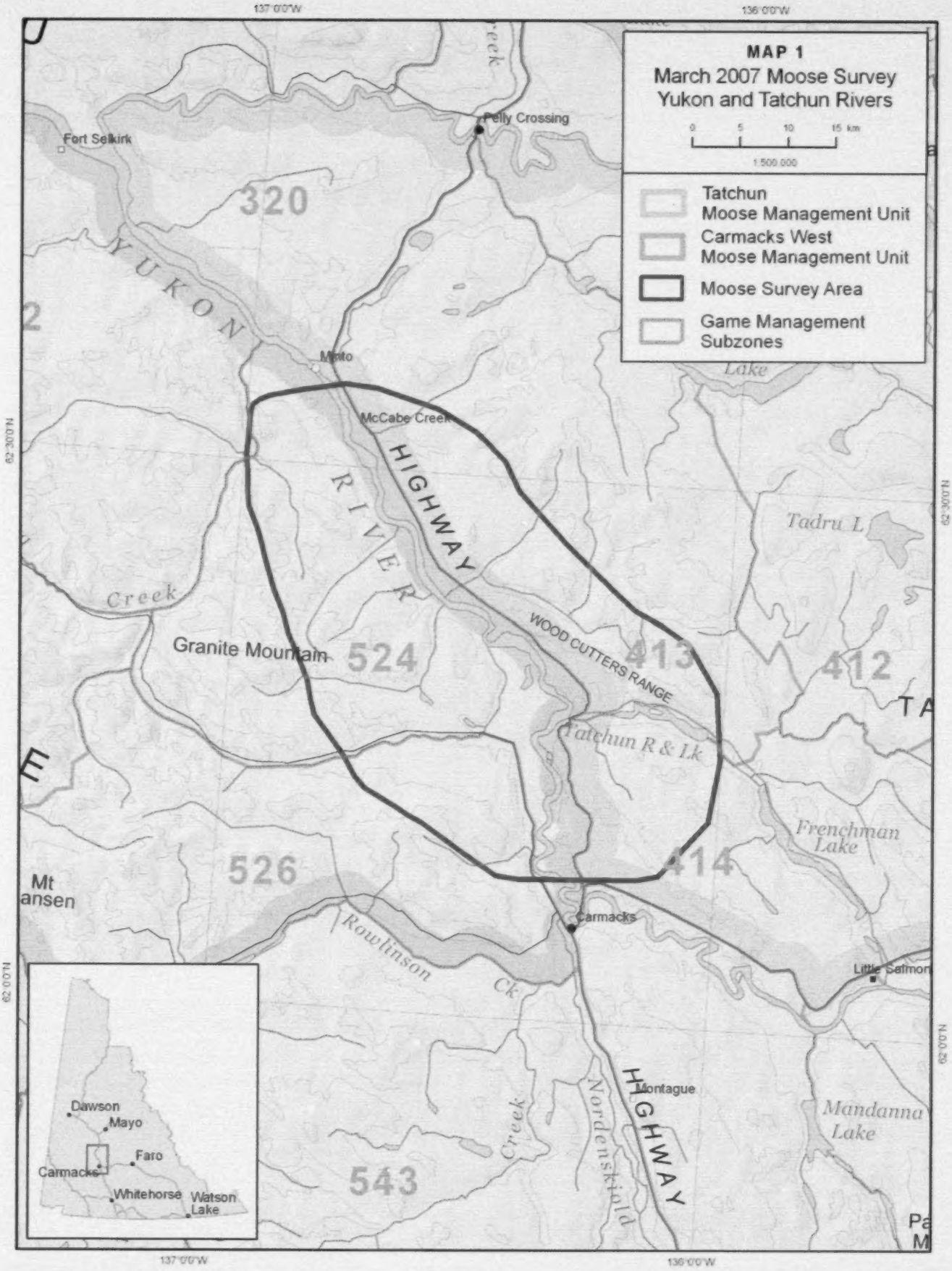
Methods

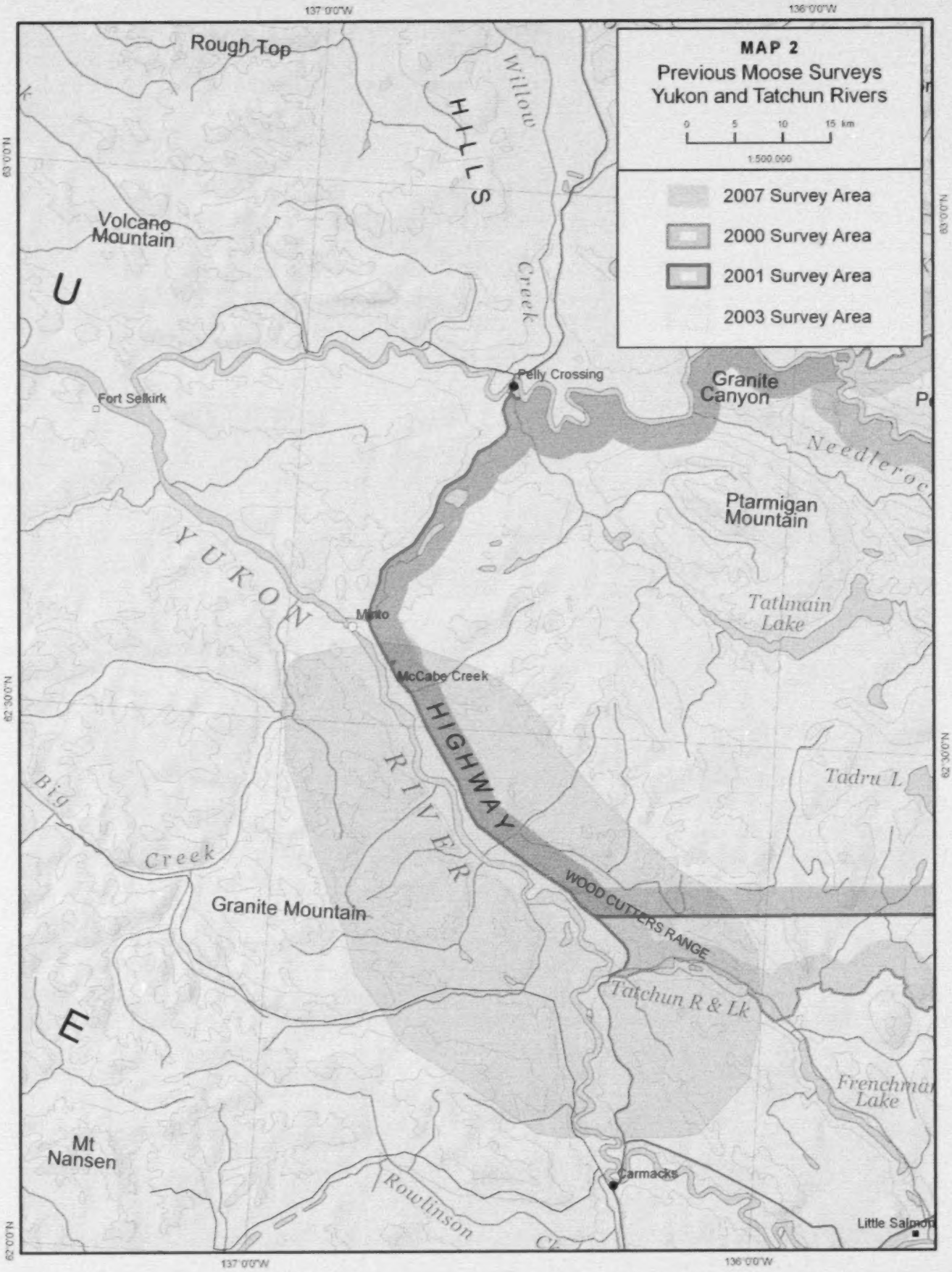
We used a survey method called "intensive stratification", which gives us good information about the distribution and areas of concentration of moose over the entire survey area. The technique involves the following steps:

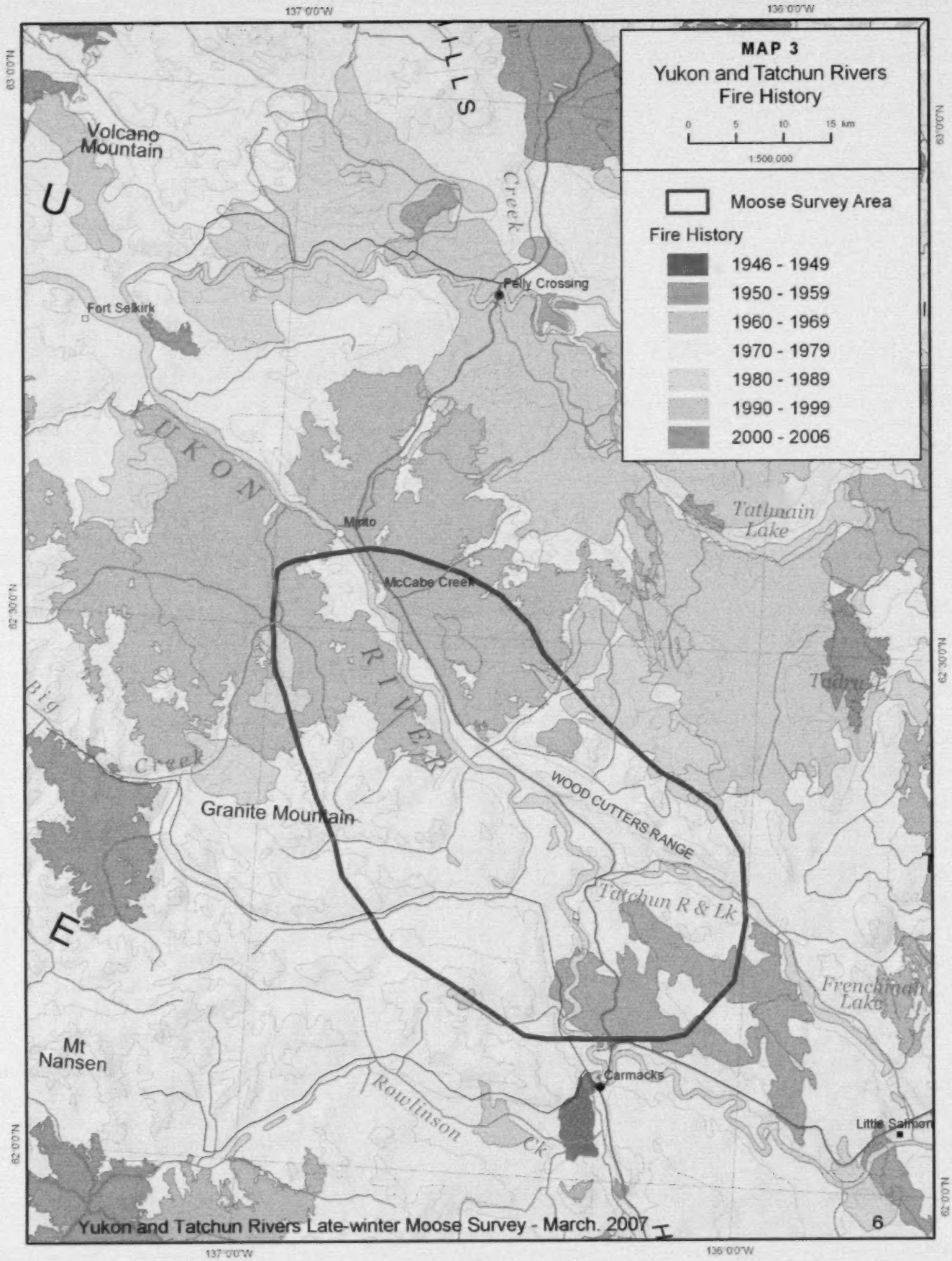
1. The survey area is divided into uniform rectangular blocks 15-16 km² (2' latitude x 5' longitude) in size.
2. Observers in fixed-wing aircraft fly over all the blocks, making about 4 passes through each block and classifying (or "stratifying") them as having either high, medium, low, or very low expected moose abundance, based on local knowledge, number of moose seen, tracks, and habitat. This is the same as the "stratification" part of a full census survey, except that we cover the area at about four times the intensity (0.5 minutes per km²) to get more complete information.
3. We count and get a GPS location of each moose or group of moose we see. We classify all moose seen by age (adult or calf) when possible, but we do not put as much effort into this as we do during censuses when we are making estimates of population composition. Except for cows with calves, we do not try to determine the sexes of moose.

Weather and Snow Conditions

Weather conditions for this survey were generally good. Temperatures ranged from -43°C to -16°C. Skies were clear at the beginning of the survey, and cloudy with some light snow on the last 2 days of flying. Winds were fairly light at 0-17 kph. Light conditions ranged from flat to bright and snow coverage was complete, so visibility was generally good for spotting moose. Visibility was limited on one day by light snow.


MAP 1
March 2007 Moose Survey
Yukon and Tatchun Rivers
0 5 10 15 km
1:500,000
Tatchun Moose Management Unit
Carmacks West Moose Management Unit
Moose Survey Area
Game Management Subzones
137°0'0"W
136°0'0"W
62°30'0"N
62°0'0"N
Fort Selkirk
Pelly Crossing
320
YUKON
Minto
McCabe Creek
HIGHWAY
RIVER
Granite Mountain
524
WOOD CUTTERS RANGE
413
412
Tadru L
Tatchun R & Lk
Frenchman Lake
526
414
Carmacks
Rowlinson Ck
Little Salmon
Montague
HIGHWAY
Nordenskiold
Creek
543
Mandanna Lake
Dawson
Mayo
Faro
Carmacks
Whitehorse
Watson Lake


MAP 2
Previous Moose Surveys
Yukon and Tatchun Rivers
0 5 10 15 km
1:500,000
2007 Survey Area
2000 Survey Area
2001 Survey Area
2003 Survey Area
137°0'0"W
136°0'0"W
63°0'0"N
62°30'0"N
62°0'0"N
Rough Top
Willow Creek
HILLS
Volcano Mountain
Fort Selkirk
Pelly Crossing
Granite Canyon
Needleroc
Ptarmigan Mountain
YUKON
Minto
Tatlmain Lake
McCabe Creek
HIGHWAY
RIVER
Tadru L
Big Creek
Granite Mountain
WOOD CUTTERS RANGE
Tatchun R & Lk
Frenchman Lake
Mt Nansen
Carmacks
Rowlinson
Little Salmon


MAP 3
Yukon and Tatchun Rivers
Fire History
0 5 10 15 km
1:500,000
Moose Survey Area
Fire History
1946 - 1949
1950 - 1959
1960 - 1969
1970 - 1979
1980 - 1989
1990 - 1999
2000 - 2006
137°0'0"W
136°0'0"W
63°0'0"N
62°30'0"N
62°0'0"N
Volcano Mountain
Pelly Crossing
Fort Selkirk
YUKON
Minto
McCabe Creek
RIVER
Tatlmain Lake
Tadrud L
Big Creek
Granite Mountain
WOOD CUTTERS RANGE
Tatchun R & Lk
Frenchman Lake
Mt Nansen
Carmacks
Rowlinson Ck
Little Salmon
Yukon and Tatchun Rivers Late-winter Moose Survey - March, 2007
6

Results and Discussion

Coverage

It took us about 18.6 hours to count moose in the 101 blocks in the survey area, for a search intensity of 0.69 minutes per km². This is higher than our target search intensity of 0.5 minutes per km², and corresponded with flying through each block about 4 or 5 times and circling animals when needed to verify sightings. We needed an additional 3.2 hours to ferry to and from the survey area and fuel supplies in Carmacks. The time devoted to ferrying was about 15% of the total flight time.

Observations of Moose

We counted a total of 76 moose; 62 of them were adults and 14 were calves (see Table 1). We spent 1,115 minutes (18.6 hours) searching the survey blocks for moose, so we saw an average of 0.07 moose per minute of survey time.

Distribution of Moose

Moose were widely distributed in the survey area, but most observations were in the northern part of the survey area (see Map 4) most moose were seen in habitats with abundant willows in the area burned in 1995, and many were on hillsides in the burn. We saw relatively few moose in the denser forested habitats in the Yukon River valley. This could partially reflect differences in visibility of moose in the different habitats. Sightability of moose was undoubtedly better in the more open burned areas than in riparian forests, but we did not see evidence from tracks that we were missing any large concentrations of moose in the dense spruce along the river.

Moose typically concentrate in river valleys in the central Yukon during winters of deep snow, moving down from their preferred early-winter subalpine habitats when snow depths get too deep as the winter progresses (Fraser et al. 2001, O'Donoghue 2005). Snowfall in the Carmacks area was average to above normal during the winter of 2006-2007 (Yukon Department of Environment 2007), but snow depths at nearby snow survey stations (Mount Berdoe, Williams Creek, and Mount Nansen) ranged from 41 cm to 56 cm, which are lower than those that would negatively affect moose (above 70 cm; Peek 1997). Distribution of willows likely affected habitat use by moose in this area in late winter 2007 more than did snow depths.

Ages and Sexes of Moose

We classified all of the moose we saw by age, but we cannot translate these directly into estimates of the composition of the moose population in the study area. Stratification surveys such as this are aimed mostly at determining the distribution of moose in the survey area. The data are valuable for mapping important habitats and also for dividing up the survey blocks covering the area into "strata" or categories of high and low expected densities of moose for future late-winter surveys.

Table 1. Observations of moose during the March 2007 survey along the Yukon and Tatchun rivers.

	Number Observed	Percentage of Moose Observed
Adults	62	82
Calves	14	18

The observed proportions of moose of different ages that we saw were likely biased compared to those of the actual population. Previous surveys have shown that cow moose, particularly cows with calves, tend to space themselves away from other moose more than bulls do, so that there is a higher proportion of cows in low-density survey blocks than there is in high-density blocks. Low-density blocks also typically have lower sightability, because forest canopies are, on average, denser. As a result of these differences in sightability, we likely miss seeing more cows and calves than we do bulls when we search over all habitats with the same intensity, so our observations will be biased. Census surveys, in which survey blocks are searched very intensively and counts are corrected for sightability, are more appropriate for estimating population composition than are intensive stratification surveys.

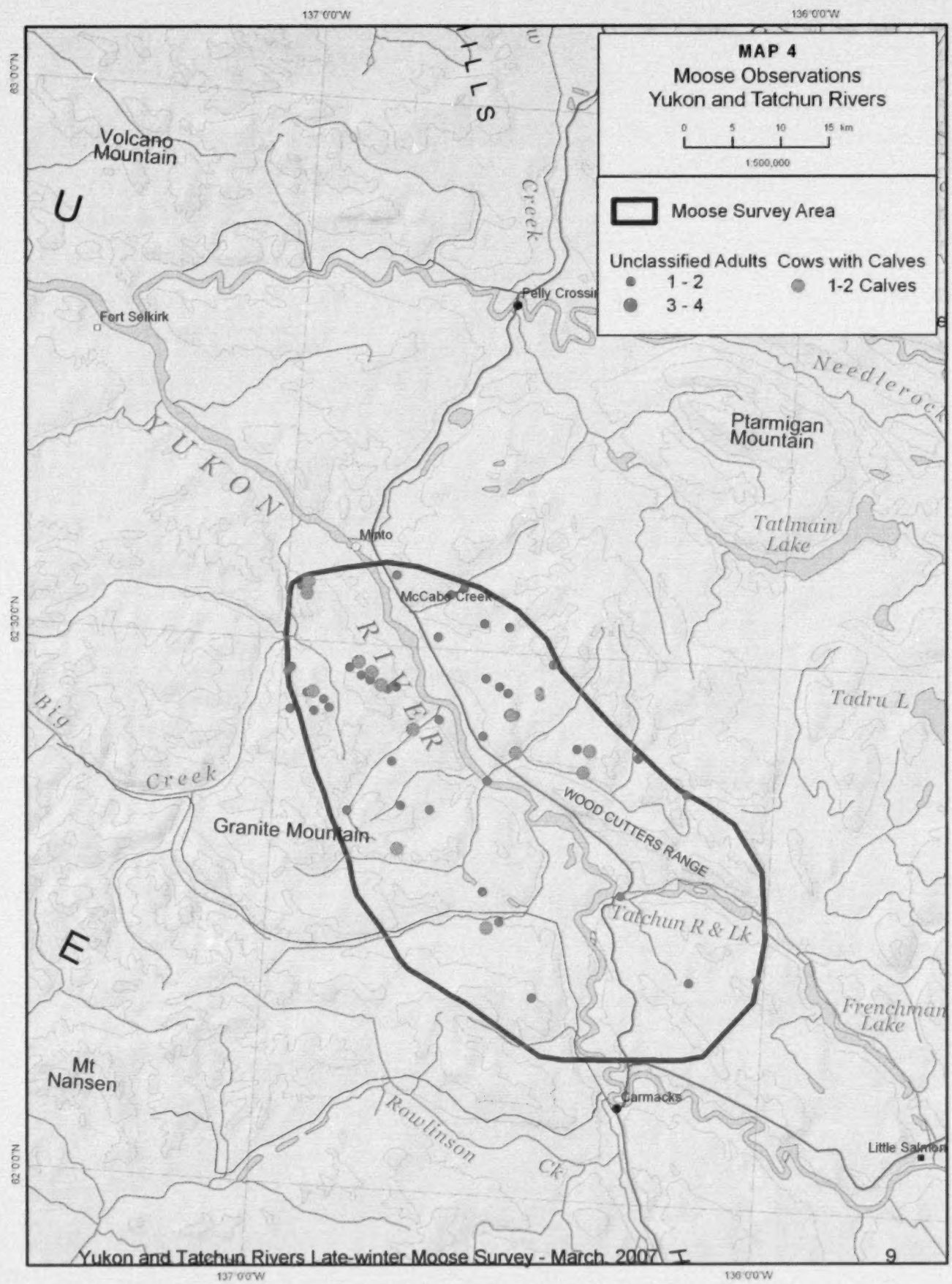
The age classifications observed in this survey can be compared directly with the results from similar late-winter surveys in the future. Our observed composition index was 18% calves in the population. Although likely biased low, 18% calves is quite high compared to the percentage found in late-winter surveys elsewhere in the Yukon (average of 12% calves observed), so it is likely that survival of calves to 10 months of age was good in this area during the last year.

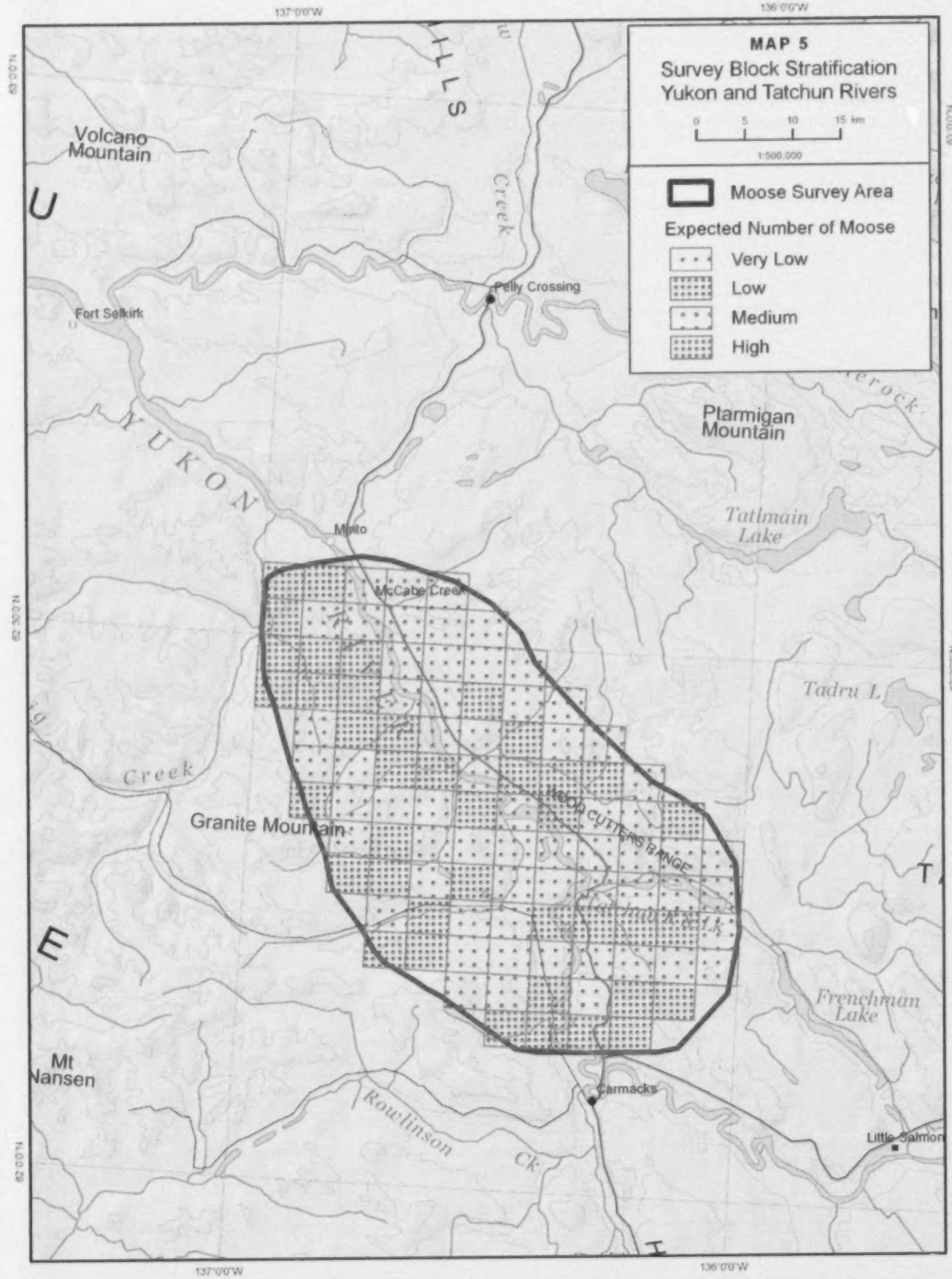
Identification of High and Low-Density Blocks

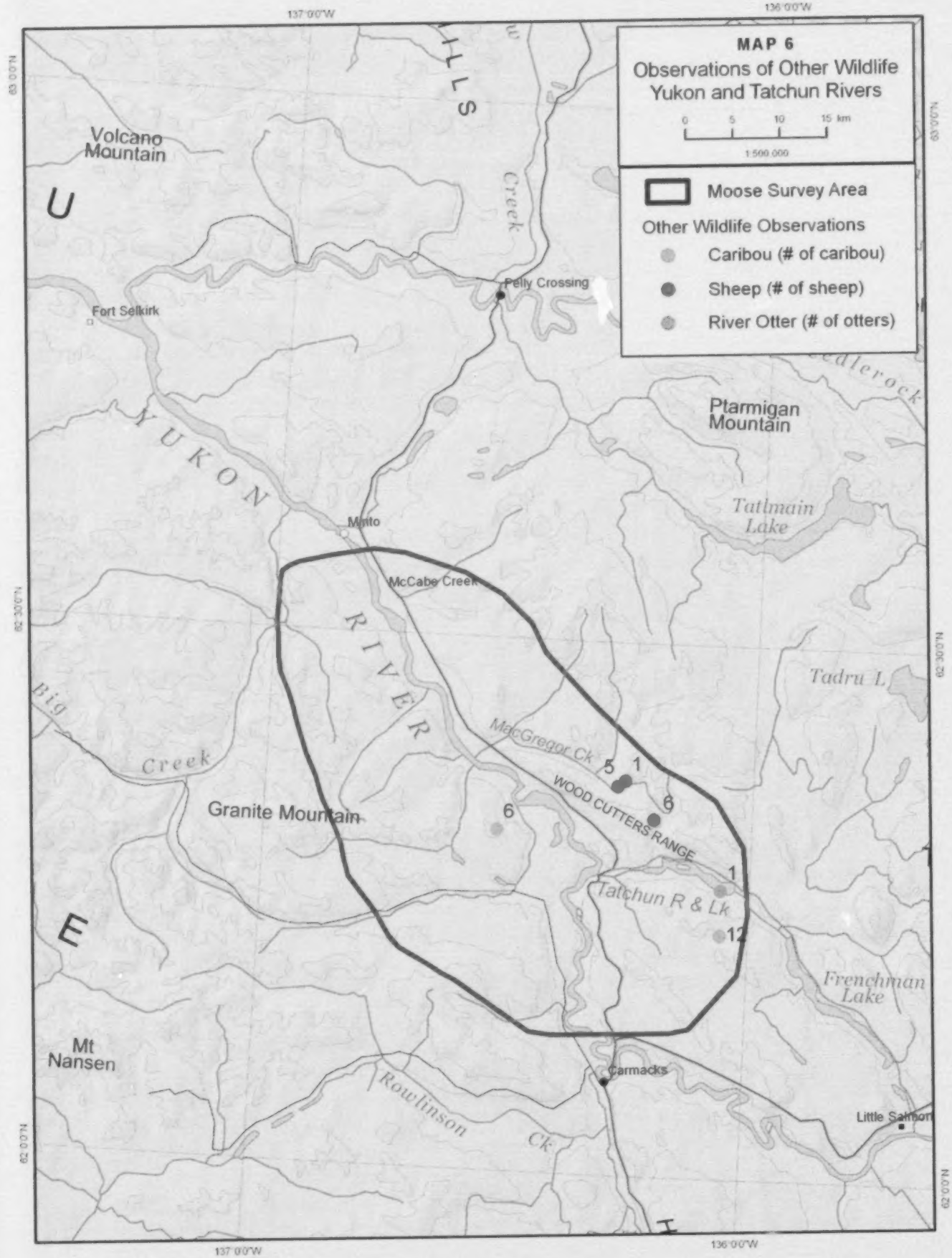
We divided the survey blocks into four categories of expected moose density, for use in future late-winter surveys of the area. We classified 10 (10%) of the 101 survey blocks as high, 34 (34%) as medium, 30 (30%) as low, and 27 (27%) as very low expected abundance of moose (see Map 5), based on our observations from the air. Most of the blocks with higher expected numbers of moose were located in the 1995 burn in the north, where we observed highest numbers of moose in this survey, and in hilly habitat away from the Yukon River in the south. In deep-snow winters, the distribution of moose in the area may be more concentrated into the river valley.

Other Wildlife Sightings

During the survey, we also recorded sightings of other notable observations of wildlife besides moose. We saw 2 groups of caribou; one was a group of 12 south of Tatchun Lake in the usual wintering habitat of the Tatchun caribou herd, and the other was a group of 6 west of the Yukon River that was between the mapped winter ranges of the Tatchun and Klaza herds. We saw 3 groups of sheep totaling 12 animals in the canyons along a tributary of MacGregor Creek and on bluffs in the Wood Cutters Range north of Tatchun Lake. We also observed a river otter on the east end of Tatchun Lake.


MAP 4
Moose Observations
Yukon and Tatchun Rivers
0 5 10 15 km
1:500,000
Moose Survey Area
Unclassified Adults
1 - 2
3 - 4
Cows with Calves
1-2 Calves
137°0'0"W
136°0'0"W
63°0'0"N
62°30'0"N
62°0'0"N
Volcano Mountain
Fort Selkirk
Pelly Crossing
Creek
Needlerock
Ptarmigan Mountain
YUKON
Minto
Tatlmain Lake
McCabe Creek
RIVER
Big Creek
Granite Mountain
WOOD CUTTERS RANGE
Tadru L
Tatchun R & Lk
Frenchman Lake
Mt Nansen
Carmacks
Rowlinson Ck
Little Salmon


MAP 5
Survey Block Stratification
Yukon and Tatchun Rivers
0 5 10 15 km
1:500,000
Moose Survey Area
Expected Number of Moose
Very Low
Low
Medium
High
137°0'0"W
136°0'0"W
63°0'0"N
62°30'0"N
62°0'0"N
Volcano Mountain
Fort Selkirk
Pelly Crossing
Creek
YUKON
Ptarmigan Mountain
Tatlmain Lake
Minto
McCabe Creek
Tadru L.
Granite Mountain
MOOR CUTTER RANGE
Frenchman Lake
Mt Nansen
Carmacks
Rowlinson Ck
Little Salmon


MAP 6
Observations of Other Wildlife
Yukon and Tatchun Rivers
0 5 10 15 km
1:500,000
Moose Survey Area
Other Wildlife Observations
Caribou (# of caribou)
Sheep (# of sheep)
River Otter (# of otters)
137°0'0"W
136°0'0"W
63°0'0"N
62°30'0"N
62°0'0"N
Volcano Mountain
Fort Selkirk
Pelly Crossing
Creek
Ptarmigan Mountain
Tatlmain Lake
Minto
McCabe Creek
YUKON RIVER
Big Creek
MacGregor Ck
WOOD CUTTERS RANGE
Granite Mountain
Tatchun R & Lk
Tadru L
Frenchman Lake
Mt Nansen
Carmacks
Rowlinson Ck
Little Salmon
5
1
6
6
1
12

Conclusions and Recommendations

- Habitat with abundant willows in hilly terrain and recent burns supported the highest densities of moose in this area in late winter 2007. The 1995 burn in the Minto area had the largest concentration of moose in the area. Snow depths were above normal in this area this winter but still well below those at which we would expect movements of moose to be negatively affected. Local knowledge indicates that moose in this area typically concentrate more in the larger river valleys during winters with deep snow.
- Recruitment of moose appears to have been good in this area during the past year.
- Given the interest in this area for agricultural development, we should map distribution of moose during a winter with deep snow depths to document key late-winter habitats.

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